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Paper Abstract

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Gov't Agency/Lab The Subject Technology Was Developed By/For: NASA

Paper Title: SATS: Small, Automated Tracking System — A New Better System for Satellite Tracking and Telemetry

Category: Electronics or Test and Measurement

Description:

'I'he Jet Propulsion Laboratory (JPL) is developing a new integrated tracking and telemetry system for Earth orbiting satellites. This system is expected to offer significant cost and operational advantages over conventional satellite tracking and telemetry systems currently in use. The new system exploits technology from the Global Positioning System (GPS). For low-Earth orbiters, it includes a GPS receiver/telemetry transponder onboard the user satellite, and a new, compact ground terminal for data reception. The system would be comprised of relatively inexpensive ground antennas and receivers with an autonomous and automated operational capability, including remote control if desired. For high-altitude orbiting users, an enhanced GPS ground receiver can be used for the orbit determination, simultaneously tracking both GPS satellites and the user satellite.

SATS — Small Automated Tracking System — provides two major functions: tracking and navigation; and telemetry. A tracking demonstration for orbit determination took place in early 1994 for NASA's geosynchronous (high-altitude) Tracking and Data Relay Satellites (TDRS) utilizing a prototype ground terminal which consists basically of a GPS TurboRogue receiver enhanced to enable simultaneous tracking of GPS and TDRS satellites. JPL is studying the use of this ground terminal for tracking of other geosynchronous satellites, as well as satellites at other altitudes. In the TDRS tracking demo, three of the ground terminals were deployed in a regional ground network in the Southwest United States, The TDRS orbit from the demo is accurate to about 20 meters. The integration of Earth orbiter tracking with GPS tracking in one ground terminal provides two major advantages

for orbit determination: (1) the GPS data provides a built-in precise calibration for geodetic parameters, clock offsets, and atmospheric delays; and (2) the system can be highly automated based on procedures already developed for GPS data processing and analysis. Navigation and orbit determination for low-Earth orbiters using GPS flight instruments has been done at JPL for several different satellites. For Topex, the orbit accuracy achieved is at the several-cm level of accuracy. In fact, with various combinations of flight and ground GPS-based terminals, SATS can support orbit determination ranging from several km to several cm accuracies, depending on the altitude of the satellite, cost, and the available power, mass, and space.

The telemetry portion of SATS is presently in the concept stage. The approach taken at JPL focuses on providing significant savings in cost, power, and mass on the spacecraft by integrating GPS and uplink receiver functions. The new system will use direct carrier modulation for both the uplink and downlink and will use GPS as the primary navigation instrument, greatly reducing the complexity of typical near-Earth transponders. The integrated GPS receiver/telemetry transponder offers significant advantages to satellite users, both for autonomous navigation and telemetry. The new SATS is adaptable to either low-Earth, high-Earth, or geosynchronous satellites, It offers a better, cheaper approach to satellite tracking, communications and telemetry. It is expected that the new system will be especially useful to NASA, the military, other government agencies, and the commercial satellite sector.